Parts 1-5 are worth 4 points
Parts 6-8 are worth 4 points
Due at the start of class on 10-31
(Even if you are absent Thursday, it is still due.)

ACTIVITY 11
APPLICATIONS OF POLYNOMIAL FUNCTIONS

The Park and Planning Commission decided to consider three factors when attempting to improve the daily profits at their sports facility:

- The number of all-day admission tickets sold
- The cost of operating the facility
- The price of each all-day admission ticket

After carefully analyzing their operating costs, they found that it would be impossible to cut them further.

Daily Operating Costs

Advertisements	$ 55.00
Employees' pay	$310.00
Heat, lights, taxes, food, rent	$435.00

Knowing that the maximum number of potential patrons is 200, the Park and Planning Commission decided to vary the price of each admission ticket to see what effect this change might have on the number of tickets sold. After much experimentation, they collected the following sales data:

Ticket Price (in $)	Average Number of Tickets Sold
5	158
7	142
9	119
11	97

1. Using this information, suggest the optimal ticket price for all-day admission to the sports facility. If you feel the need for more information, please explain why.

2. Use a graphing tool to find the function rule of best fit for the (price, sales) data. Express the number of tickets sold as a function N of the ticket price. That is, $N(x) = ?$, where x is the price of the ticket. Produce a rough sketch of the (price, sales) data and the fitted function. Do you expect the function to behave like any of the linear, exponential, or rational functions studied so far? If yes, explain your reasoning.

ACTIVITY 11 (CONTINUED)

APPLICATIONS OF POLYNOMIAL FUNCTIONS

The Park and Planning Commission used an expanded set of (price, sales) data and two basic economic principles,

Revenue = Price charged per item × number of items sold

and

Profit = Revenue – Costs,

to arrive at the following rule for daily profit as a function p of the price of an all-day admission ticket:

$$p(x) = (-8x + 200)x - 800,$$

or

$$p(x) = -8x^2 + 200x - 800.$$

3. Use this rule to generate a function table and graph for ticket prices ranging from \$0 to \$25 in increments of \$1. Record your table and a rough sketch of your graph on a separate piece of paper. Hint: Use your calculator table function. See me for help!

   (*a*) Describe the trend in profits as prices increase.

   (*b*) What properties of the relation between price and profit can be best learned from the table? From the graph?

4. What information does the solution to the equation below reveal about the Park and Planning Commission situation?

$$-8x^2 + 200x - 800 = 0$$

Use your table and graph from question 3.

5. (*a*) The manager estimates that each person spends an average of \$3.50 on refreshments. How would you modify the daily profit function,

$$p(x) = x(-8x + 200) - 800 = -8x^2 + 200x - 800,$$

to reflect the revenue earned from concession sales?

   (*b*) Compare the function tables and graphs of the original and new profit rules. Write out the table from 0-22 but not the graph.

6. Taking into account all the foregoing information, recommend the optimal ticket price for all-day admission to the sports facility. Support your recommendation with function tables and graphs. You need to justify your answer. You do not need to make more tables, graphs, etc. Your justification needs to be mathematically sound and it needs to be detailed.

7. Explain how you know $f(x) = -8x^2+200x-800$ is a quadratic function.

8. Name one new thing you learned by completing this activity.